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and armies. Neither is he a cultivator of natural science. Whatever the word may have meant in the past, it has, in common speech, come to mean a believer in that philosophy of evolution which, according to such evolutionists as Huxley, is 'premature.' Since this is so, and since the growth of language is beyond individual control, would it not be well for them to stand where Huxley stands, and 'have nothing to say to any philosophy of evolution,' to stop calling themselves 'Evolutionists,' and to be content with the good old name of 'Naturalist?'

To the pious evolutionist, who asks what will become of the fixed order of nature if we are not convinced that everything is determinate, we answer that, while this sort of reasoning is not new, it has a strange sound in the mouth of a student of science. The order of nature has outlasted many systems of philosophy, and it may survive others. We have found our astronomy and our geology and our law of the mutability of species, and none of the dreadful things predicted by 'philosophers' have come about. There may still be more things in heaven and earth than are dreamed of in 'philosophy.'

History warns us that, as the price of progress in science, all the idols of the theater, and all other idols, "must be abjured and renounced with firm and solemn resolution, and the understanding must be completely freed and cleared of them, so the access to the kingdom of man, which is founded on the sciences, may resemble that to the kingdom of heaven, where no admission is conceded except to children."

If the world thinks hard names are the just due of them who assert their living wish to know, while humbly confessing ignorance, the biologist must bear up as well as he can if he is called a 'scientific Rip Van Winkle,' or an 'agnostic,' or even 'a turbaned and malignant Turk.'

If we seek admission to the temple of

natural knowledge naked and not ashamed, like little children, hard names cannot hurt us, nor need they scare us.

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*FERMENTATION WITHOUT LIVING CELLS
AND SYNTHETIC PROTEIN.*

I TAKE pleasure in complying with the request of the Editor to furnish the readers of SCIENCE with a brief abstract of the papers read at the late Vienna Congress by Professor Buchner, of Tübingen, and Dr. Lillienfeld, of Vienna, on 'Fermentation without Cells' and 'The Synthesis of Albumenoids,' respectively. The paper of Professor Buchner was presented to the whole Congress on the occasion of the first general meeting, July 28, 1898. The paper was illustrated with numerous experiments showing the production of vigorous fermentation within the time occupied by reading the paper, secured by ferments entirely free of yeast cells. The active principle of the yeast cells is obtained by grinding the yeast with quartz sand, for the purpose of disrupting the cells, and subsequently submitting the moist mass to a high pressure, viz: 500 atmospheres. Nearly all the yeast cells are disrupted by this process, and a microscopic examination of the residue discloses the empty cells from which all liquid contents have been removed. A more complete evacuation of the contents of the cells is secured by breaking up and moistening the press cake and repeating the grinding and pressure. About half a liter of liquid is obtained from a kilogram of yeast. The liquid contents of the cells, as they come from the press, are filtered through fine paper, in order to remove any danger of whole yeast cells being found in the extract.

The resultant liquor is clear or slightly opalescent, has a yellowish color and the pleasant odor of yeast. It contains con-

siderable quantities of carbon dioxid and some coagulable albumen. That the prepared juice contains enzymes is easily shown by the hydrogen peroxid test. Hydrocyanic acid has the property of forming a very unstable compound with these enzymes whereby the action of hydrogen peroxyd is prevented, and scarcely any oxygen is given off from such a mixture until the acid has been partly or entirely removed by a current of air. Of the enzymes present invertin has been detected, and it is probable that another ferment capable of hydrolyzing maltose and glycogen is present.

Most interesting is the deportment of the yeast juice towards sugars. Fermentation is set up much quicker than by yeast and proceeds much faster. Quite a number of sugar solutions treated with the ferment at the beginning of the paper were in rapid action before the close. The evolved gas is almost pure carbon dioxid. The reaction is made much quicker if a small amount of sugar is dissolved in large volume of the yeast liquor. The vitality of the ferments continues for two or three days, after which time their activity is rapidly diminished. When carefully dried at a low temperature the vitality of the ferments is not destroyed, and it is probable that in a desiccated state the active properties of the mixture may be kept indefinitely without loss.

It follows, as a result of these investigations, that living cells are not necessary to fermentation, and thus another of the fetiches of the old chemistry is destroyed. Fermentation can no longer be regarded as a physiological act produced by living organisms. It is simply due to the chemical power of an amylolyte acting in a manner entirely similar to the ordinary digestive ferments. It has not yet been possible to isolate the fermentative enzyme, partly because of its instability, but chiefly because of the presence of other enzymes, such as invertin and the oxydases, which deport

themselves analytically in the same manner as the fermenting bodies.

In regard to the practical uses which may be made of this discovery little can be said. By reason of the fact that the fermentative organisms can be preserved in a dry state, it ought to be possible to secure a more general distribution of those particular yeasts which give the highly-prized flavors to beers and even to wines. If this be the case the flavors which are produced in the great breweries of the Old World might be produced under proper conditions in the breweries in other countries. It would be wise, however, to postpone any discussion of the practical applications of the discovery of fermentation without living cells until the matter has been more thoroughly worked out from the purely scientific point of view.

The paper of Dr. Lilienfeld, as has already been intimated, referred to the synthesis of a nitrogenous body having the properties of a peptone or even of an albuminoid or proteoid. The synthesis of such a peptone or peptonoid marks a distinct step forward in synthetical work in the field which has already been partly developed by Grimaux, Pickering, Williamson and others.

We can only now speak, however, of its centesimal composition. The state of its molecular condensation and atom position can only be determined by securing large quantities of the product and submitting it to chemical and digestive studies. It is probable that, as in the case of sugars, the artificial peptone will lack the vital element. In other words, while the chemist has succeeded in building molecules which resemble, in every outward respect, those built up by Nature, they are uniformly dead, without cell functions or cell activity. The details of this important scientific work must be awaited before a final judgment in regard to its far-reaching importance can be formulated.

The synthesis of peptone is effected by the condensation of phenol with glyccoll with the help of phosphoroychlorid. A hydrochlorate of peptone results, which gives all the characteristic reactions of protein. By conversion into sulfate and the decomposition of the latter the free peptone is obtained, which it is claimed by Lilienfeld is similar both in chemical and physiological properties to the natural product.

It is evident from the method of preparation that the product contains no sulfur, since the only sulfur-containing ingredient used was sulfuric acid, and this could not possibly enter into the organic preparation. Granting that a peptonoid body was produced, the synthesis of a true proteid, which must contain sulfur, is still undemonstrated.

The color reactions which are supposed to be characteristic of protein must not be relied on too surely. They are probably due to decomposition, and not to the action of the molecule as a whole. It is stated by Pickering that a mixture of tyrosin, indol and biuret will give all the reactions characteristic of a proteid. If the prospects of artificial food depended on these so-called synthetic products the vocation of the geonist would be assured for many millions of years to come.

The interesting fact, however, in papers of this kind is found in the accomplishment of steps which a few years ago were considered improbable or impossible. It is certain that the chemist is now able to produce organic compounds, or bodies which closely resemble them, in great numbers, if not in considerable quantities. Practically, such investigations will lead to further studies in the domain of synthetic chemistry and doubtless to the discovery of many additional synthetic products of great utility. In so far as the production of artificial food is concerned, however, there seems to be

absolutely no possibility of Nature's methods ever being supplanted or even greatly supplemented by the synthetical products of the laboratory.

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THE 'FEELING OF BEING STARED AT.'

EVERY year I find a certain proportion of students, in my junior classes, who are firmly persuaded that they can 'feel' that they are being stared at from behind, and a smaller proportion who believe that, by persistent gazing at the back of the neck, they have the power of making a person seated in front of them turn round and look them in the face. The phenomena are said to occur in any sort of assembly—at church, in the class room, in a public hall. The 'feeling,' when it is not merely described as 'uncanny,' 'a feeling of Must,' etc., is referred to as a state of unpleasant tension or stiffness at the nape of the neck, sometimes accompanied by tingling, which gathers in volume and intensity until a movement which shall relieve it becomes inevitable. It is believed that this stiffness is, in some way or other, the direct effect of the focussing of vision upon the back of the head and neck.

The belief rests upon a foundation of fact, but (like most popular beliefs) implies a misinterpretation of fact. The psychology of the matter is as follows: (1) We are all of us more or less 'nervous' about our backs. If you observe a seated audience, before it has become absorbed in the music or lecture for which it came together, you will notice that a great many women are continually placing their hands to their heads, smoothing and patting their hair, and every now and again glancing at their shoulders or over their shoulders to their backs; while many of the men will frequently glance at or over their shoulders,